National Aeronautics and Space Administration

Network-Enabled Air Traffic Management: A Vision for the Future

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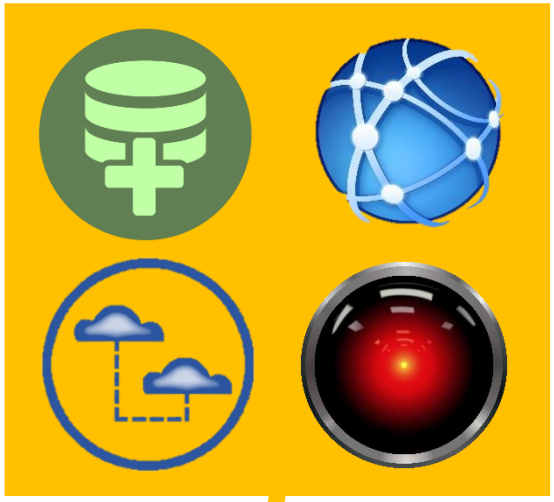
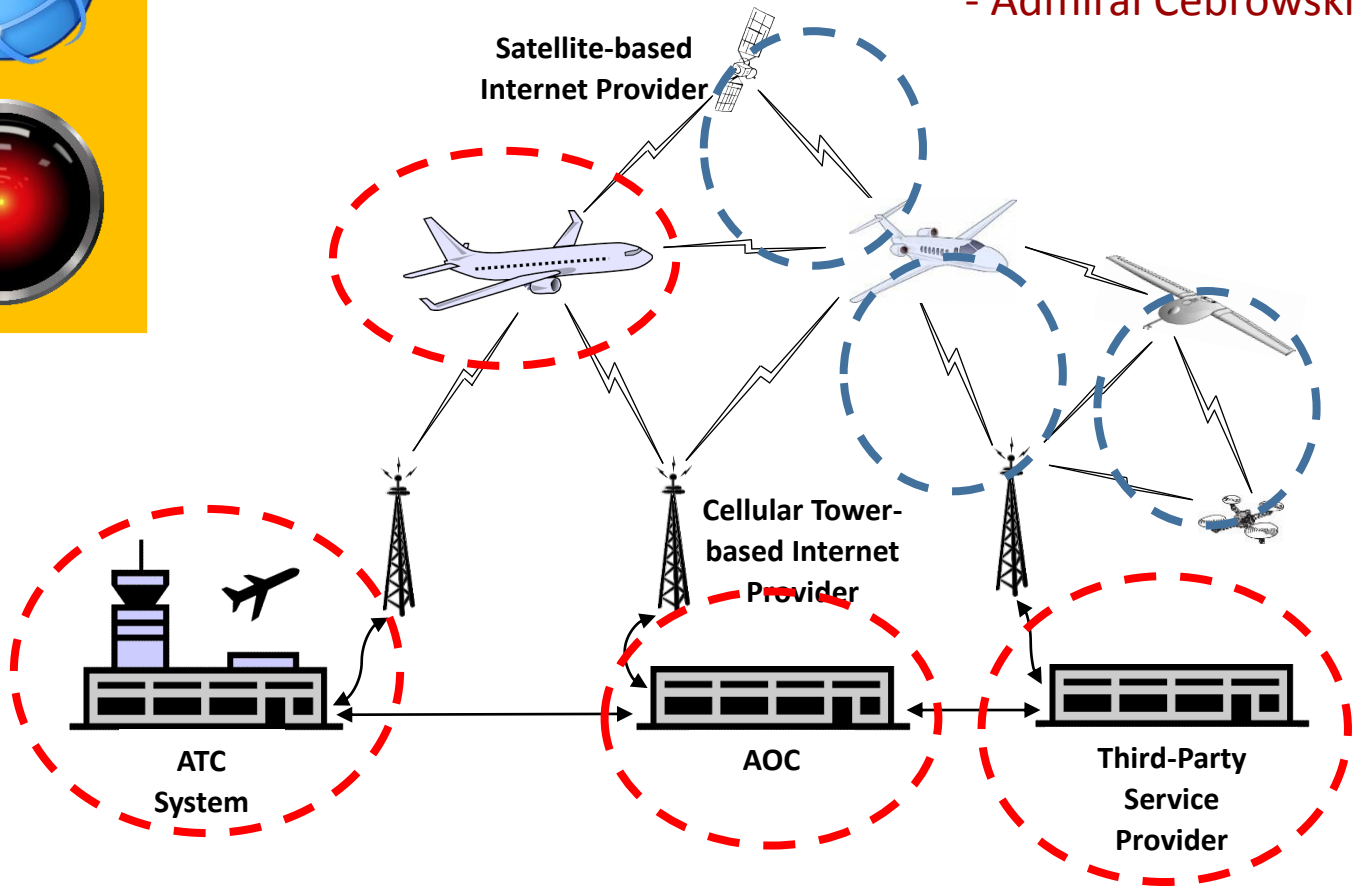
What is Network-Enabled Air Traffic Management?

- A vision for future National Airspace System operations



Available on the App Store

"…the age of the small, the fast, and the many…"
- Admiral Cebrowski



Why NASA?

- Rich history of Air Traffic Management concept development
- Provides benefits and enhanced capabilities aligned with three of the six NASA Aeronautics Strategic Implementation Plan Thrusts

Thrust 1: Safe, Efficient Growth in Global Operations

Thrust 5: Real-Time System-Wide Safety Assurance

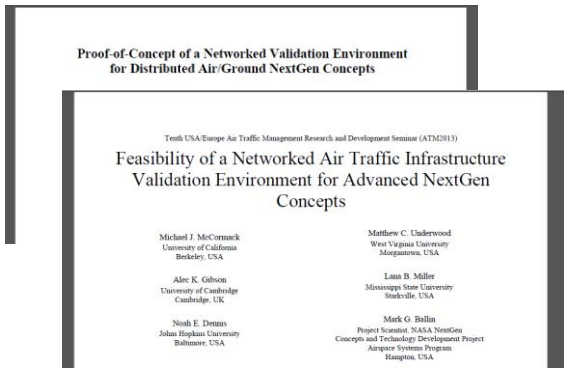
Thrust 6: Assured Autonomy for Aviation Transformation

What challenges do we face?

- **Conceptual Questions & Concerns**
  - Alignment of benefits to various stakeholders
  - Function allocation realignment
  - Cloud-computing concepts
  - Big Data/Machine Learning concepts
- **Data Questions & Concerns**
  - What data should be shared and with whom?
  - Where does the data come from?
  - Is the data currently available from the respective systems?
  - Is the data standardized?
  - What level of “added value” is required for the data?
  - Data security, integrity, reliability
- **Operations Questions & Concerns**
  - Moving from human-centric to computer-centric
- **On-board Avionics Questions & Concerns**
  - Data-link system requirements
  - System safety, robustness, reliability
  - Use of in-flight Internet
  - Processing power on-board aircraft
- **Ground-based Systems Questions & Concerns**
  - Centralized vs. Distributed?
  - System safety, robustness, reliability
- **Human Factors Questions & Concerns**
  - Human-Data interactions
  - Human-Machine interfaces
  - Function allocation realignment
  - What is the human acceptance of these technologies?

What is LaRC currently doing to provide solutions to these problems?

2012- NATIVE


Proof-of-Concept of a Networked Validation Environment for Distributed Air/Ground NextGen Concepts

Tenth USA/Europe Air Traffic Management Research and Development Seminar (ATM2013)

Feasibility of a Networked Air Traffic Infrastructure Validation Environment for Advanced NextGen Concepts

Michael J. McCormack, University of California, Berkeley, USA
Alec K. Gibson, University of Cambridge, Cambridge, UK
Noah E. Dennis, Johns Hopkins University, Baltimore, USA
Matthew C. Underwood, West Virginia University, Morgantown, USA
Lana B. Miller, Mississippi State University, Starkville, USA
Mark G. Ballin, Project Scientist, NASA NextGen Concepts and Technology Development Project, Airspace Systems Program, Hampton, USA

Rockwell Collins | Georgia Tech Research Institute | gogo | Federal Aviation Administration

Virgin america | Alaska Airlines | Global Connected Aircraft 2015 Summit

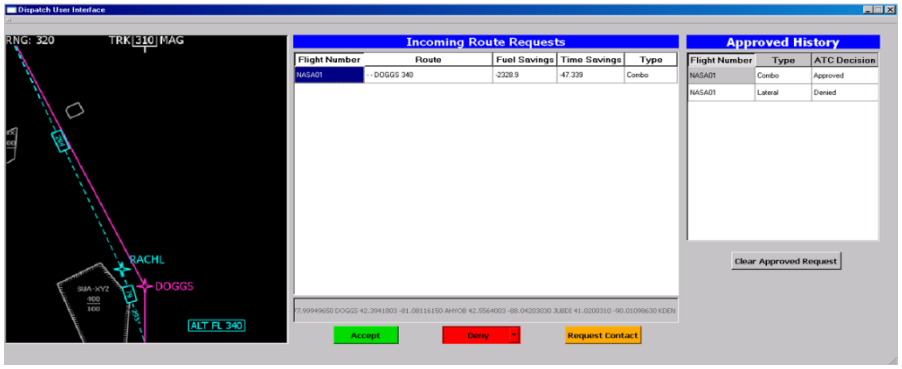
Sabre Travel Network | IBM

2015- Meetings with Industry & Government

2015- Net-Enabled Impact Assessment

NASA | SBIR · STTR

2015- SBIR



2015- FALCN

ARMD NRA

2015- Net-Enabled NRA Subtopic

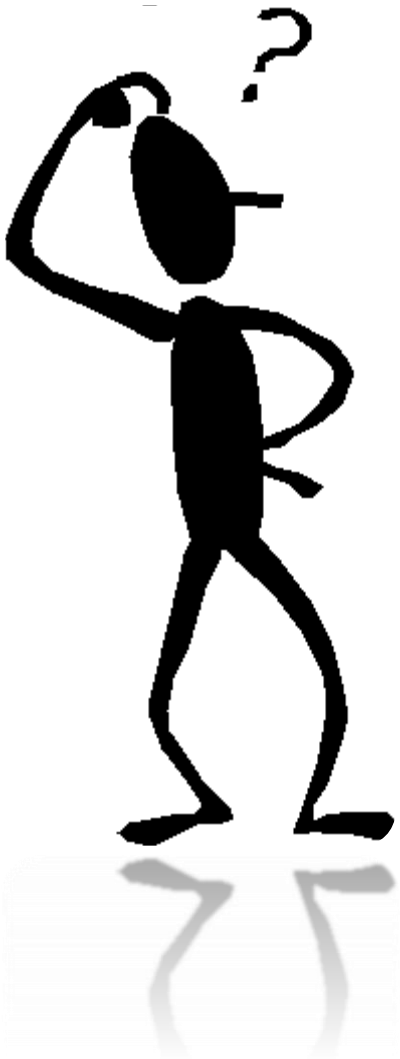
2015- Concept/Application Brainstorming

What else can we do with this?

- Trajectory Sharing and Negotiation through Network Connectivity
- Trajectory-Based Operations
- Autonomous Vehicle Operations
- Net-Enabled Highways in the Sky
- Autonomous Departure and Arrival Procedures and Technologies
- Collaborative Resource Scheduling
- Real-Time System Safety Diagnostics
- Real-Time System Efficiency Prognostics
- ATM System Resiliency and Robustness via State Perturbations
- Operator Intent Inferencing and Consolidation
- Real-time Airline Operations Adjustments
- Remote Operation of Vehicle with Disabled/Impaired Pilot
- Aircraft as Sensors Providing Weather Data to Prediction Models
- Automation Management
- Crowd-mapping Techniques applied to Airspace Operations
- Navigational Resiliency
- Aircraft Systems History Monitoring
- Digital Black Box
- On-Board Silent Alarm

And others!

These concepts and applications have the potential to be game-changing and are a key enabler for NASA's vision of future Air Traffic Systems



Questions?